HALL TICKET NO. | | | | | | | |

SET CODE : **T2**

BOOKLET SL. NO. 109378

NAME OF THE CANDIDATE

BOOKLET CODE : **B**

SIGNATURE OF THE CANDIDATE

INVIGILATOR'S SIGNATURE

(CVL)

CIVIL ENGINEERING

INSTRUCTIONS TO CANDIDATES

1. Candidates should write their Hall Ticket Number only in the space provided at the top left hand corner of this page, on the leaflet attached to this booklet and also in the space provided on the OMR Response Sheet. **BESIDES WRITING, THE CANDIDATE SHOULD ENSURE THAT THE APPROPRIATE CIRCLES PROVIDED FOR THE HALL TICKET NUMBERS ARE SHADED USING BALL POINT PEN (BLUE/BLACK) ONLY ON THE OMR RESPONSE SHEET. DO NOT WRITE HALL TICKET NUMBER ANY WHERE ELSE.**
2. Immediately on opening this Question Paper Booklet, check:
   (a) Whether **200** multiple choice questions are printed (**50** questions in Mathematics, **25** questions in Physics, **25** questions in Chemistry and **100** questions in Engineering)
   (b) In case of any discrepancy immediately exchange the Question paper Booklet of same code by bringing the error to the notice of invigilator.
3. Use of Calculators, Mathematical Tables and Log books is not permitted.
4. **Candidate must ensure that he/she has received the Correct Question Booklet, corresponding to his/her branch of Engineering.**
5. **Candidate should ensure that the booklet Code and the Booklet Serial Number, as it appears on this page is entered at the appropriate place on the OMR Response Sheet by shading the appropriate circles provided therein using Ball Point Pen (Blue/Black) only. Candidate should note that if they fail to enter the Booklet Serial Number and the Booklet Code on the OMR Response Sheet, their Answer Sheet will not be valued.**
6. **Candidate shall shade one of the circles 1, 2, 3 or 4 corresponding question on the OMR Response Sheet using Ball Point Pen (Blue/Black) only. Candidate should note that their OMR Response Sheet will be invalidated if the circles against the question are shaded using pencil or if more than one circle is shaded against any question.**
7. One mark will be awarded for every correct answer. **There are no negative marks.**
8. The OMR Response Sheet will not be valued if the candidate :
   (a) Writes the Hall Ticket Number in any part of the OMR Response Sheet except in the space provided for the purpose.
   (b) Writes any irrelevant matter including religious symbols, words, prayers or any communication whatsoever in any part of the OMR Response Sheet.
   (c) Adopts any other malpractice.
9. Rough work should be done only in the space provided in the Question Paper Booklet.
10. No loose sheets or papers will be allowed in the examination hall.
11. Timings of Test: 10.00 A.M. to 1.00 P.M.
12. Candidate should ensure that he / she enters his / her name and appends signature on the Question paper booklet, leaflet attached to this question paper booklet and also on the OMR Response Sheet in the space provided. Candidate should ensure that the invigilator puts his signature on this question paper booklet, leaflet attached to the question paper booklet and also on the OMR Response Sheet.
13. Before leaving the examination hall candidate should **return both the OMR Response Sheet and the leaflet attached to this question paper booklet** to the invigilator. Failure to return any of the above shall be construed as malpractice in the examination. **Question paper booklet may be retained by the candidate.**
14. This booklet contains a total of **32** pages including Cover page and the pages for Rough Work.

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Note: *(1) Answer all questions.*

(2) Each question carries 1 mark. There are no negative marks.

*(3) Answer to the questions must be entered only on OMR Response Sheet provided separately by completely shading with **Ball Point Pen (Blue/Black)**, only one of the circles 1, 2, 3 or 4 provided against each question, and which is most appropriate to the question.*

(4) The OMR Response Sheet will be invalidated if the circle is shaded using pencil or if more than one circle is shaded against each question.

MATHEMATICS

1. $\int\left(\frac{x+2}{x+1}\right)dx =$

(1) $x \log (x+1) + c$ (2) $x \log (x+1) + 2 \log (x+1) + c$

(3) $x + \log (x+1) + c$ (4) $\frac{1}{x}\log (x+1) + c$

2. $\int \frac{x^2}{\sqrt{1+x^6}}dx =$

(1) $\frac{1}{2}\sin^{-1}(x^3) + c$ (2) $2\cos^{-1}(x^3) + c$

(3) $\frac{1}{2}\cos h^{-1}(x^3) + c$ (4) $\frac{1}{3}\sin h^{-1}(x^3) + c$

3. $\int 8x^3 e^{2x}\,dx =$

(1) $(4x^3 - 6x^2 + 6x - 3)\,e^{2x} + c$ (2) $4x^3 + 6x^2 + 6x + 3e^{2x} + c$

(3) $\left(\frac{4x^2}{3} - \frac{2}{3}x + \frac{1}{3}\right)e^{2x} + c$ (4) $\left(\frac{4x^2}{3} + \frac{2}{3}x - \frac{1}{3}\right)e^{2x} + c$

4. $\lim_{n\to\infty}\left[\frac{1}{n} + \frac{1}{n+1} + \frac{1}{n+2} + \ldots + \frac{1}{3n}\right] =$

(1) $\frac{\pi}{3}$ (2) $\frac{\pi}{4}$ (3) $\log 2$ (4) $\log 3$

5. $\int_0^{\frac{\pi}{2}} \frac{\sqrt{\sin x}}{\sqrt{\cos x}+\sqrt{\sin x}}dx =$

(1) $\frac{\pi}{2}$ (2) $\frac{\pi}{4}$ (3) 0 (4) 2

6. The area of the region in the first quadrant enclosed by x–axis, y–axis, $y = 3x-2$ and $y = 4$ is

(1) 16 (2) 8 (3) $\frac{16}{3}$ (4) $\frac{8}{3}$

7. The root mean square (RMS) value of $\log x$ over the range $x = 1$ to $x = e$ is

(1) $\frac{\sqrt{(e+1)}}{\sqrt{(e-2)}}$ (2) $\frac{\sqrt{(e-2)}}{\sqrt{(e-1)}}$ (3) $\frac{\sqrt{(e+2)}}{\sqrt{(e+1)}}$ (4) $\frac{\sqrt{(e+2)}}{\sqrt{(e-1)}}$

8. The differential equation formed by eliminating the arbitrary constants a and b in the relation $y = a\cos(nx+b)$ is

(1) $\frac{d^2y}{dx^2}+n^2y=0$ (2) $\frac{d^3y}{dx^3}-x^3y=0$

(3) $\frac{dy}{dx}+ny=0$ (4) $\frac{d^2y}{dx^2}-y=0$

9. The solution of $\frac{dy}{dx}=e^{x-y}$

(1) $e^x-e^{-y}+c=0$ (2) $e^{x-y}+c$

(3) $e^x+e^{-y}+c=0$ (4) $e^x-e^y+e^c=0$

10. The solution of the differential equation $\tan x\frac{dy}{dx}+y=\sec x$ is

(1) $y\sin x-x=c$ (2) $y\cot x+x=c$

(3) $y=\tan x+c$ (4) $y.\operatorname{cosec} x=x+c$

11. The solution of the linear third order equation $\frac{d^3y}{dx^3} - 7\frac{d^2y}{dx^2} + 16\frac{dy}{dx} - 12y = 0$ is

(1) $y = c_1 e^{3x} + c_2 e^{x} + c_3 e^{4x}$
(2) $y = c_1 e^{3x} + c_2 xe^{x} + c_3 e^{4x}$
(3) $y = c_1 e^{2x} + c_2 xe^{3x} + c_3 e^{4x}$
(4) $y = c_1 e^{3x} + (c_2 + c_3 x) e^{2x}$

12. If $y_1 = e^x$ and $y_2 = e^{-x}$ are two solutions of the homogeneous differential equation; then

(1) $y_3 = e^{2x}$ and $y_4 = e^{-2x}$ are also solutions of the equation
(2) $y_3 = xe^x$ and $y_4 = xe^{-x}$ are also solutions of the equation
(3) $y_3 = \cosh x$ and $y_4 = \sinh x$ are also solutions of the equation
(4) $y_3 = \cos x$ and $y_4 = \sin x$ are also solutions of the equation

13. The particular integral (P.I) of the equation $(D^2+D-6)y = 5e^{2x} + 6$ is

(1) $xe^{2x} - 1$
(2) $e^{2x} + 1$
(3) $5xe^{2x} + 1$
(4) $e^{2x} - 1$

14. The particular integral of $(D^2+16)\,y = 8\cos 4x$ is

(1) $\cos 4x$
(2) $x \sin 4x$
(3) $-\frac{1}{4}\sin 4x$
(4) $-\frac{1}{4}\cos 4x$

15. If $A = \begin{bmatrix} 2 & 4 & 3 \\ 1 & 0 & 2 \\ -3 & 5 & 1 \end{bmatrix}$ then,

(1) $A = A^T$
(2) A is a diagonal matrix
(3) A is a singular matrix
(4) A is a nonsingular matrix

16. If $A=\begin{bmatrix}2 & 5 & 3\\ 3 & 1 & 2\\ 1 & 2 & 1\end{bmatrix}$ then

(1) The minors of first row elements are respectively $-3, -1, 5$
(2) The cofactors of second row elements respectively are $1, -1, 1$
(3) The cofactors of first row elements respectively are $-3, -1, -5$
(4) The minors of second row elements respectively are $7, 5, -13$

17. If A, B, C are non singular matrices of order 3 then

(1) $A(BC) \neq (AB)C$ (2) $(ABC)^T = A^T B^T C^T$
(3) $(ABC)^{-1} = C^{-1} B^{-1} A^{-1}$ (4) $(ABC)^{-1} = 1/(ABC)$

18. If $\begin{bmatrix}3 & 2\\ 2 & -3\end{bmatrix}\begin{bmatrix}x\\ y\end{bmatrix}=\begin{bmatrix}4\\ 7\end{bmatrix}$, then

(1) $x=-1, y=4$ (2) $x=2, y=-1$
(3) $x=4, y=-1$ (4) $x=-1, y=2$

19. If w is the cube root of unity then $\begin{bmatrix}1 & w & w^2\\ w & w^2 & 1\\ w^2 & 1 & w\end{bmatrix}=$

(1) 0 (2) 1 (3) -1 (4) 2

20. If $\frac{x^2+13x+15}{(2x+3)(x+3)^2}=\frac{A}{2x+3}+\frac{B}{x+3}+\frac{C}{(x+3)^2}$ then C =

(1) 10 (2) 5 (3) 3 (4) 1

21. If $\frac{2x+1}{(x^2+1)(x-1)}=\frac{Ax+B}{x^2+1}+\frac{C}{x-1}$ then $A=$

(1) -1 (2) $\frac{2}{3}$ (3) $-\frac{3}{2}$ (4) $-\frac{2}{3}$

22. Which of the following statement is TRUE
(A) The period of $\sin x$ is π and the period of $\operatorname{cosec} x$ is 2π
(B) The period of $\cos x$ is 2π and the period of $\sec x$ is 2π
(C) The period of $\tan x$ is 2π and the period of $\cot x$ is π
(D) The period of $\operatorname{cosec} x$ is π and the period of $\sec x$ is 3π
(1) A (2) B (3) C (4) D

23. The range of $3\cos\theta - 4\sin\theta$ is
(1) $[-1, 1]$ (2) $[0, 4]$ (3) $[-5, 5]$ (4) $[-4, 0]$

24. If $A+B=45°$, then $(1+\tan A)(1+\tan B) =$
(1) 0 (2) 1 (3) $\frac{1}{2}$ (4) 2

25. $\left(\frac{\sin 2A}{1-\cos 2A}\right)\left(\frac{1-\cos A}{\cos A}\right) =$
(1) $\tan\frac{A}{2}$ (2) $\cos\frac{A}{2}$ (3) $\sec\frac{A}{2}$ (4) $\operatorname{cosec}\frac{A}{2}$

26. The value of $\frac{\sin 70° - \cos 40°}{\cos 50° - \sin 20°} =$
(1) 1 (2) $\frac{1}{\sqrt{2}}$ (3) $\frac{1}{\sqrt{3}}$ (4) 0

27. $4\sin\frac{11\theta}{2}\cos\frac{11}{2}\theta\cos 5\theta$ expressed as sum or difference is
(1) $\sin 15\theta - \sin 6\theta$ (2) $\sin 16\theta + \sin 6\theta$
(3) $\sin 11\theta + \sin 8\theta$ (4) $\sin 11\theta - \sin 8\theta$

28. If $2\cos^2\theta + 11\sin\theta = 7$, the principal value of θ is
(1) $60°$ (2) $45°$ (3) $30°$ (4) $22\frac{1}{2}°$

29. Which one of the following equation is FALSE

(1) $\cos^{-1}(-x) = \pi - \cos^{-1} x$ (2) $\sin^{-1}(-x) = \pi - \sin^{-1} x$

(3) If $-1 \le x \le 1$, then $\cos^{-1}x + \sin^{-1} x = \frac{\pi}{2}$ (4) $\sin^{-1}x \neq \frac{1}{\sin x}$

30. In any triangle ABC, $\Sigma (b+c)\cos A =$

(1) $a+b+c$ (2) $2(a+b+c)$ (3) $3(a+b+c)$ (4) 0

31. With the usual notation, in a triangle ABC

$$s\left[\frac{r_1 - r}{a} + \frac{r_2 - r}{b} + \frac{r_3 - r}{c}\right] =$$

(1) $2(r_1+r_2+r_3)$ (2) $3(r_1+r_2+r_3)$ (3) $r_1+r_2+r_3$ (4) 0

32. The modulus amplitude form of $-\sqrt{3} + i$ is

(1) $2 \text{ cis } \frac{5\pi}{6}$ (2) $2 \text{ cis } \frac{3\pi}{6}$ (3) $2 \text{ cis } \frac{\pi}{3}$ (4) $2 \text{ cis } \frac{\pi}{6}$

33. If $x = \cos\theta + i \sin\theta$, then the value of $x^6 + \left(\frac{1}{x^6}\right)$

(1) 0 (2) $2i \sin 6\theta$ (3) $2 \cos 6\theta$ (4) $2(\cos 6\theta + \sin 6\theta)$

34. The most general second degree equation $ax^2+2hxy+by^2+2gx+2fy+c = 0$ represents a circle if

(1) $a+b = 0, h = 0$ (2) $a-b = 0, h = 0$

(3) $a-b = 0, h \neq 0$ (4) $a+b \neq 0, h \neq 0$

35. The equation of the circle whose radius is $\sqrt{(a^2 - b^2)}$ and whose center is $(-a, -b)$ is

(1) $x^2+y^2+2ax+2by+2a^2 = 0$ (2) $x^2+y^2-2ax+2(a^2+b^2) = 0$

(3) $x^2+y^2+2ax+2by+2(a^2-b^2) = 0$ (4) $x^2+y^2+2ax+2bx+2b^2 = 0$

36. The coordinates of the parabola $y^2 = 18x$ such that the ordinate equals to three times of the abscissa is

(1) (3, 9) (2) (2, 6) (3) (1, 3) (4) (162, 54)

37. With respect to the ellipse $5x^2+7y^2 = 11$, the point $(4, -3)$
(1) Is a focus
(2) lies with in the ellipse
(3) lies outside the ellipse
(4) lies on the ellipse

38. For the Hyperbola $4x^2-9y^2 = 36$, the coordinates of the foci are
(1) $\left(\pm\sqrt{13},0\right)$ (2) $\left(\pm\sqrt{31},0\right)$ (3) $\left(\pm 6.0\right)$ (4) $\left(0,\pm 6\right)$

39. Which of the following statements are FALSE
(A) The equation of the tangent at the point (x', y') of the circle $x^2+y^2 = a^2$ is $xx' + yy' = a^2$
(B) The eccentricity of a parabola is unity
(C) The eccentricity of an ellipse is greater than unity
(D) The eccentricity of a hyperbola is less than unity
(1) A, B (2) A, D (3) B, C (4) C, D

40. $\lim_{x \to \infty} \frac{3^{x+1}+4}{3^{x+2}+4} =$
(1) 1 (2) 0 (3) $\frac{3}{4}$ (4) $\frac{1}{3}$

41. Derivative of $\cos^{-1}\left(\frac{1-x^2}{1+x^2}\right)$ with reference to x is
(1) $\frac{2}{1+x^2}$ (2) $\frac{1}{1-x^2}$ (3) $2x$ (4) $\sqrt{\left(1+x^2\right)}$

42. If $y = x^{3x}.(x > 0)$ then $\frac{dy}{dx} =$
(1) $3.x^{3x-1}$ (2) $3x^{2x}$ (3) $3y(1+\log x)$ (4) $\frac{3y}{\log x}$

43. If $x^{\frac{2}{3}} + y^{\frac{2}{3}} = a^{\frac{2}{3}}$ then $\frac{dy}{dx} =$

(1) $\left(\frac{x}{y}\right)^{\frac{1}{3}}$ (2) $-\left(\frac{y}{x}\right)^{\frac{1}{3}}$ (3) $-\left(\frac{x}{y}\right)^{\frac{1}{3}}$ (4) $\left(\frac{y}{x}\right)^{\frac{1}{3}}$

44. The derivative of log sec x with respect to tan x is
(1) sec x . tan x (2) cos x . cot x (3) cos x . sin x (4) sec x . cot x

45. The coordinates of the point $P(x, y)$ on the curve of $y = x^2-4x+5$ such that the tangent at P is parallel to $y = 2x+4$ are
(1) (3, 2) (2) (1, 2) (3) (2, 1) (4) (5, 4)

46. The function $f(x) = x \log^2 x$ has

(1) Maximum value occurs when $x = \frac{1}{e}$ (2) Maximum value occurs when $x = e$

(3) Maximum value occurs when $x = e^{-2}$ (4) Maximum value occurs when $x = e^2$

47. In a cube the percentage increase in side is 2 units. The percentage increases in the volume of the cube is
(1) 3 (2) 6 (3) 8 (4) 16

48. The curves $x = y^2$ and $xy = m$ cut at right angle if
(1) $m = 0$ (2) $m^2 = 8$ (3) $8m^2 = 1$ (4) $m = -1$

49. If $u = e^{ax} \sin by$, then $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} =$
(1) $(a^2 - b^2)\, u$ (2) $a^2 + b^2$ (3) $(a^2 + b^2)\, u$ (4) $(a + b)\, u$

50. $\int \frac{\cos \sqrt{x}}{\sqrt{x}} dx =$

(1) $\sqrt{x} \sin \sqrt{x} + c$ (2) $2 \sin \sqrt{x} + c$ (3) $\sqrt{\cos x} + c$ (4) $\frac{\sin \sqrt{x}}{\sqrt{x}} + c$

PHYSICS

51. In thermodynamics, $dQ = 0$ and $dU = -dW$ is true for
(1) Isothermal process (2) Adiabatic process
(3) Isochoric process (4) Isobaric process

52. A sample of an ideal gas has volume V, pressure P and temperature T. The mass of each molecule of the gas is m. The density of the gas is _____
(1) P/kVT (2) mkT (3) mP/kT (4) P/kT

53. A gas does 4.5 J of external work during adiabatic expansion. Its temperature falls by 2 K. Its internal energy will be _____
(1) increase by 4.5 J (2) increase by 9.0 J
(3) decrease by 4.5 J (4) decrease by 2.25 J

54. One mole of an ideal gas ($\gamma = 5/3$) is mixed with one mole of diatomic gas ($\gamma = 7/5$). The value of γ of the mixture
(1) 3/2 (2) 4/3 (3) 23/15 (4) 35/23

55. In a given process on an ideal gas, $dW = 0$ and $dQ < 0$. Then for the gas _____
(1) the temperature will decrease (2) the volume will increase
(3) the pressure will remain constant (4) the temperature will increase

56. The threshold wavelength for a metal whose work function is W_0 is λ_0. The threshold wavelength for a metal whose work function is $W_0/2$ _____
(1) $\lambda_0/4$ (2) $\lambda_0/2$ (3) $4\lambda_0$ (4) $2\lambda_0$

57. The propagation of light through an optical fiber goes by the principle _____
(1) Refraction (2) Total internal reflection
(3) Interference (4) Diffraction

58. The dimensions of angular momentum are _____
(1) MLT^{-1} (2) $ML^{-1}T$ (3) ML^0T^{-2} (4) ML^2T^{-1}

59. The SI unit of universal gas constant R is _____
(1) Newton K^{-1} mol^{-1} (2) Joule K^{-1} mol^{-1}
(3) Watt K^{-1} mol^{-1} (4) erg K^{-1} mol^{-1}

60. The magnitude of the resultant of $(A+B)$ and $(A-B)$ is _____

(1) $2A$ (2) $\sqrt{(A^2+B^2)}$

(3) $2B$ (4) $\sqrt{(A^2-B^2)}$

61. Given A.B = 0 and A×C = 0, the angle between B and C is _____

(1) 135° (2) 90° (3) 180° (4) 45°

62. A projectile has a maximum range of 200m. The maximum height attained by it is _____

(1) 75 m (2) 100 m

(3) 25 m (4) 50 m

63. A block of mass M is lying on a horizontal frictionless surface. One end of a rope mass m is fixed to the block and a force F is applied at the free end parallel to the surface. The force acting on the block will be _____

(1) FM/(M-m) (2) Fm/(M+m)

(3) FM/(M+m) (4) F

64. A block of weight 200 N is pulled along a rough horizontal surface at a constant speed by a force of 100 N acting at an angle of 30°. The coefficient of friction between the block and the surface is _____

(1) 0.58 (2) 0.75 (3) 0.45 (4) 0.65

65. A boy wants to climb down a rope. The rope can withstand a maximum tension equal to two-thirds the weight of the boy. If g is the acceleration due to gravity, the minimum acceleration with which the boy should climb down the rope is _____

(1) g/3 (2) 2g/3 (3) 3g/2 (4) g

66. N bullets each of mass m kg are fired with a velocity v m/s, at the rate of n bullets per second, upon a wall. The reaction offered by the wall to the bullets is given by _____

(1) nNv/m (2) $nNmv$

(3) Nmv/n (4) nNm/v

67. A machine gun fires a bullet of mass 40 g with a velocity of 1200 m/s. The man holding it can exert a maximum force of 144 N on the gun. The number of bullets he can fire per second is _____

(1) 4 (2) 1 (3) 3 (4) 8

68. A horizontal force F pulls a 20 kg box at a constant speed along a horizontal floor. If the coefficient of friction between the box and the floor is 0.25. The work done by the force F in moving the box through a distance of 2 m _____
(1) 49 J (2) 147 J
(3) 196 J (4) 98 J

69. A uniform rod of mass *m* and length *l* is made to stand vertically on one end. The potential energy of the rod in this position is _____
(1) mgl/4 (2) mgl/2 (3) mgl (4) mgl/3

70. If momentum is increased by 20%, then kinetic energy increases by _____
(1) 44% (2) 77% (3) 55% (4) 66%

71. A particle is executing linear SHM of amplitude A. When the displacement is half the amplitude the fraction of kinetic energy is _____
(1) 1/5 (2) 3/4 (3) 1/2 (4) 1/4

72. For a particle executing S.H.M starting from equilibrium position the phase is $\pi/2$ when it has
(1) maximum displacement (2) maximum energy
(3) half the displacement (4) maximum velocity

73. A particle executes SHM between $x = -A$ and $x = +A$. The time taken for it to go from 0 to A/2 is T_1 and to go from A/2 to A is T_2. Then
(1) $T_1 = 2T_2$ (2) $T_1 = T_2$
(3) $T_1 < T_2$ (4) $T_1 > T_2$

74. Two sounds of wavelengths 5 m and 6 m, travelling in a medium produce 10 beats per second. The speed of sound in the medium _____
(1) 300 m/s (2) 320 m/s (3) 350 m/s (4) 1200 m/s

75. An observer moves towards a stationary source of sound with a velocity one tenth the velocity of sound. The apparent increase in frequency _____.
(1) 3% (2) 0.1% (3) 5% (4) 10%

84. The ion that is iso electronic with CO is
(1) NO^+ (2) O_2^+ (3) O_2^- (4) N_2^+

85. The hydrogen bond is strongest in
(1) O-H- - -S (2) S-H---O (3) F-H---F (4) F-H---O

86. The molecule having pyramidal shape
(1) PCl_3 (2) SO_3 (3) CO_3^{2-} (4) NO_3^-

87. Crystals of a sodium chloride belong to the system
(1) Orthorhombic (2) Cubic (3) Trigonal (4) Monoclinic

88. The pH of 0.05 M acetic acid is ($K_a = 2\times10^{-5}$)
(1) 2 (2) 11 (3) 10^{-3} (4) 3

89. The volume in ml. of 0.1 M solution of NaOH required to completely neutralize 100 ml of 0.3 M solution of H_3PO_3 is
(1) 60 (2) 600 (3) 300 (4) 30

90. The P^{ka} values of four carboxylic acids are 4.76, 4.19, 0.23 and 3.41 respectively. The strongest carboxylic acid among them is the one having P^{ka} value of
(1) 4.19 (2) 3.41 (3) 0.23 (4) 4.76

91. If pH value of a solution is 8, then its pOH value will be
(1) 7 (2) 1 (3) 6 (4) 10

92. The standard reduction potential for Li^+/Li, Zn^{+2}/Zn; H^+/H_2 and Ag^+/Ag are –3.05, –0.762, 0.000 and +0.80 V respectively. Which is the strongest reducing agent?
(1) Ag (2) H_2 (3) Zn (4) Li

93. The standard reduction potential for the following half-cell reactions are
$Zn = Zn^{+2} + 2e^-$ $E^\circ = -0.76V$
$Fe = Fe^{+2} + 2e^-$ $E^\circ = -0.44V$
The E.M.F. for the cell reaction $Fe^{+2} + Zn \rightarrow Zn^{+2} + Fe$ will be
(1) –0.32 V (2) +0.32 V (3) +1.20 V (4) –1.20 V

94. In salt bridge, KCl is used because
(1) KCl is present in calomel electrode
(2) K^+ and Cl^- ions are not iso electronic
(3) K^+ and Cl^- ions have the same transport number
(4) KCl is an electrolyte

95. The metal that cannot be obtained by electrolysis of aqueous solution of its salt is
(1) Ag (2) Au (3) Cu (4) Al

96. BOD of raw municipal sewage may be about
(1) 2-5 mg/lit (2) 5-10 mg/lit
(3) 150-300 mg/lit (4) 2000-3000 mg/lit

97. The pH value of potable water should be between
(1) 1 to 1.5 (2) 6.5 to 8
(3) 13 to 14 (4) 4 to 5

98. Deaeration of high pressure boiler feed water is done to reduce
(1) Foaming from boilers (2) Its dissolved oxygen content
(3) Its silica content (4) Caustic embrittlement

99. Presence of non-biodegradable substances like alkyl benzene sulphonate from detergents in polluted water stream causes
(1) Fire hazards (2) Explosion hazards
(3) Persistent foam (4) Depletion of dissolved oxygen

100. Presence of soluble organics in polluted water causes
(1) Undesirable plants growth (2) Depletion of oxygen
(3) Fire hazards (4) Explosion hazards

CIVIL ENGINEERING

101. The technique used to cross a deep gorge or wide stream, while maintaining continuty of leveling is
(1) Radical leveling
(2) Fly leveling
(3) Profile leveling
(4) Reciprocal leveling

102. Tangential method of tachometry is
(1) Slower than Stadia hair method
(2) Faster than Stadia hair method
(3) Preferred as involving less computations to get reduced distances
(4) Preferred as chances of operational error are less compared to Stadia hair method

103. Beaman's arc is
(1) a device to illuminate triangulation signals
(2) as instrument for setting circular arcs
(3) a movable hair tachometer
(4) an attachment to theodolite for simplifying reduction of readings in Stadia Surveying

104. The rational method of triangulation adjustment involves the use of
(1) Principle of least squares
(2) Weighted arithmetic mean
(3) Chord gradients
(4) Parollox correction

105. The sign of combined correction for curvature and refraction for an angle of elevation is
(1) Zero (2) Negative (3) Positive (4) No correction needed

106. True meridians at different places converge
(1) from South Pole to North Pole
(2) from the equator to north and south poles
(3) from North Pole to South Pole
(4) from the equator to east pole

107. Electronic distance measurement is based on following approaches
(1) Electro optic method and electro magnetic method
(2) Electromagnetic method natural sextant
(3) Electro optic method and spherical trigonometry
(4) Electro optic method and method of least squares

108. Latitude of a place is the triangular distance
(1) from the Greenwich to the place
(2) from the equator
(3) from the equator to the nearest pole
(4) from the equator towards nearer pole along the meridian of the place

109. The absolute positioning of GPS
(1) relies upon single receiver station
(2) relies upon second receiver known as reference point
(3) differential geographical positioning system
(4) realtime kinetic fixed

110. The coefficient of velocity is determined experimentally by using the relations
(1) $C_v = \sqrt{\frac{y^2}{4xH}}$ (2) $C_v = \sqrt{\frac{x^2}{4yH}}$ (3) $C_v = \sqrt{\frac{4xH}{y^2}}$ (4) $C_v = \sqrt{\frac{4yH}{x^2}}$

111. Surface tension is expressed in
(1) N/m (2) N/m^2 (3) N/m^3 (4) N-m

112. The fundamental S.I unit of pressure is N/m^2; this is also known as
(1) Pascal (2) Stoke (3) Poise (4) Newton

113. Hot wire Anemometer is used for measuring

(1) Viscosity (2) Velocity of gases

(3) Pressure of gases (4) Velocity of fluids

114. Flow in a pipe where average flow parameters are considered for analysis is an example of

(1) Incompressible flow (2) One-Dimensional flow

(3) Two-Dimensional flow (4) Three Dimensional flow

115. The total energy represented by the Bernoulli's equation has the units

(1) N- m/sec (2) N- sec/m (3) N-m/m (4) N-m/N

116. An error of 1% in measuring head (H) will produce _____ error in discharge over a triangular notch or weir.

(1) 1% (2) 1.5% (3) 2% (4) 2.5%

117. Loss of head at exit of a pipe is given by

(1) $\frac{v^2}{2g}$ (2) $\frac{v^2}{g}$ (3) $0.5\frac{v^2}{2g}$ (4) $0.5\frac{v^2}{g}$

118. The sum of potential head and the pressure head at any point is called

(1) Velocity Head (2) Datum Head

(3) Piezometric Head (4) Loss of Head

119. The maximum efficiency corresponding to maximum power transmission through pipes is

(1) 66.7% (2) 67.6% (3) 76.6% (4) 77.6%

120. The water surface slope dy/dx in case of uniform flow in the channel is equal to

(1) 0 (2) 1 (3) ∞ (4) ± 1

121. If N is Mannings rugosity coefficient and R is hydraulic radius, the equation for chezy's constant (c) is

(1) $C = NR^{1/6}$ (2) $C = \frac{1}{N} R^{1/6}$ (3) $C = \frac{N}{R^{1/6}}$ (4) $C = N^{1/6}R$

122. The cross section of a channel is said to be the best if the

(1) Hydraulic mean depth is maximum
(2) Section has the least perimeter for a given area
(3) Roughness coefficient is maximum
(4) Section gives maximum area for a given flow

123. If SHP is shaft horse power, Mechanical efficiency of a centrifugal pump is given by

(1) Power at the impeller / SHP
(2) SHP/ Power at the impeller
(3) Power possessed by water / Power at the impeller
(4) Power possessed by water / SHP

124. The driving or motive force in a Francis turbine is attributed to

(1) Change in velocity (2) Change in pressure
(3) Change in momentum (4) Change in angular momentum

125. Find the delta for a crop when its duty is 864 hectares/ cumec on the field, the base period of this crop is 120 days.

(1) 100cm (2) 110cm (3) 120cm (4) 125cm

126. Average water depth (Delta) required for Sugarcane is

(1) 45cm (2) 60cm (3) 75cm (4) 90cm

127. The relation between Return period (T) and Exceedence Probability (P) is

(1) $P = e^T$ (2) $T = e^P$
(3) $T = 1/P$ (4) $T = \log P$

128. Station Year method is used

(1) To estimate the missing rainfall data

(2) To estimate the average depth of rainfall over a basin

(3) To check the in consistency of rainfall data

(4) To find annual rainfall data at a particular station

129. The rise in the maximum flood level upstream of the weir caused due to the construction of the weir across the river is called

(1) Attenuation (2) Afflux

(3) Recuperation (4) Haunting

130. Trough spillway or open channel spillway is also known as

(1) Ogee spillway (2) Chute spillway

(3) Shaft spillway (4) Syphon spillway

131. To prevent the base material from passing through the pores of the filter of earthen dams the ratio of D_{15} of filter to D_{85} of base material does not exceed

(1) 4 to 5 (2) 5 to 6

(3) 6 to 7 (4) 7 to 8

132. If the allowable stress of the dam material is 340 t/m^2, specific gravity of the dam material is 2.4, specific weight of the water is 1 t/m^3, the limiting height of the dam is

(1) 34m (2) 98m

(3) 100m (4) 24m

133. When the full supply level of the canal is sufficiently below the bottom of the train trough, so that the canal water flows freely under the gravity, the structure is known as

(1) Aqueduct (2) Syphon Aqueduct

(3) Canal Syphon (4) Super passage

134. If 'd' is average particle size in mm, the equation for Lacey's silt factor 'f' is given by

(1) $f = 7.15d$ (2) $f = 1.75\sqrt{d}$

(3) $f = 1.75d$ (4) $f = 7.15\sqrt{d}$

135. Bulk modulus is

(1) Inversely proportional to modulus of Elasticity
(2) One third of the modulus of Elasticity
(3) Half of the modulus of Elasticity
(4) Directly proportional to modulus of Elasticity

136. For a 12 mm diameter steel rod test specimen, the suitable gauge length is

(1) 24 mm (2) 36 mm
(3) 72 mm (4) 60 mm

137. Stress necessary to cause a non proportional or permanent extension equal to a defined percentage of gauge length is called as

(1) Rupture stress (2) Proof stress
(3) Working stress (4) Allowable stress

138. A mild steel specimen is tested under tension and a continuous graph between load and extension is obtained. A load at which there is considerable extension without increase in resistance is called

(1) Ultimate load (2) Breaking load
(3) Lower yield load (4) Upper yield load

139. The strength of beam depends upon

(1) Modulus of elasticity (2) Bending moment
(3) Section modulus (4) Radius of curvature

140. For a certain material Poisson's ratio is 0.25. Then the ratio of modulus of elasticity to the modulus of rigidity for the material is

(1) 0.4 (2) 2.5 (3) 4 (4) 0.5

141. A round bar A of length L and diameter D is subjected to an axial force producing stress σ. Another round bar B of the same material but diameter 2D and length 0.5 L is also subjected to the same stress σ. The ratio of strain energy in bar A to the strain energy bar B is given by

(1) 2.0 (2) 1.5

(3) 1.0 (4) 0.5

142. A load of 1kN suddenly acts on a bar with 0.8 cm^2 area of cross section and length 10cm. The maximum stress developed in the bar is

(1) 12.5 N/mm^2 (2) 25 N/mm^2

(3) 75 N/mm^2 (4) 125 N/mm^2

143. The strain energy in a bar under certain loading is 40.00 joules. The area of the bar is 400 mm^2 and length is 2m. The modulus of resilience in mm-N/mm^3 is

(1) 0.05 (2) 0.5 (3) 5.0 (4) .005

144. A material which has the elastic constants identical in all directions is called as

(1) Isotropic (2) Homogeneous

(3) Elastic (4) Ductile

145. The curvature of the axis of a beam under bending is

(1) Inversely proportional to bending moment

(2) Inversely proportional to flexural rigidity

(3) Directly proportional to flexural rigidity

(4) Doesn't related to flexural rigidity

146. A free body diagram is

(1) the diagram of the body freed from all the forces that have been acting

(2) the diagram of the body or a part of the body in isolated equilibrium

(3) the diagram of the body with no supports at all

(4) the diagram showing support reactions only

147. Compared to bending deformation, shear deformation is
(1) large (2) small
(3) very large (4) zero

148. Shear stress is maximum, where
(1) Bending stress is minimum (2) Bending stress is maximum
(3) Bending stress is zero (4) Bending stress is negative

149. Shear stress for a shaft being subjected to torque T is minimum
(1) at half of radius from the axis
(2) at axis of the shaft
(3) at equal radial distances from the axis
(4) at its both ends

150. A simply supported beam 10m long carries point loads. When S.F. diagram is drawn, there are two rectangles of the size 10 kN × 2m, one is starting from one end and above the base. The other starting from the other end but below the base line. The B.M. at the centre of the beam is
(1) 60 kNm (2) 50 kNm (3) 30 kNm (4) 20 kNm

151. The following section is the most efficient in carrying bending moments
(1) Rectangular section (2) Elliptical section
(3) I-section (4) T-section

152. In the case of T section, the maximum bending stress will occur at
(1) Junction of web and flange (2) Extreme fibre in the flange
(3) Extreme fibre in the web (4) Neutral axis

153. For a triangular section, shear stress is maximum
(1) at a height of H/4 from base (2) at a height of 2H/3
(3) at a height of H/3 base (4) at a height of H/2 base

154. The number of equilibrium equations for a two dimensional system is

(1) 6 (2) 3 (3) 2 (4) 1

155. A solid shaft of diameter d and length l is subjected to twisting moment T. Another shaft B of the same material and diameter d and length 0.5l is also subjected to the same twisting moment T. If the angular twist in shaft A is θ, the angular twist in shaft B is

(1) 2θ (2) θ (3) 0.5θ (4) 0.25θ

156. A cantilever AB is subjected to a concentrated load at the free end the slope and deflection at the free end are $WL^2/2EI$ and $WL^3/3EI$. If the same load is applied at mid span point, the deflection at the free end will be.

(1) $\frac{5}{384}\frac{WL^3}{EI}$ (2) $\frac{5}{48}\frac{WL^3}{EI}$ (3) $\frac{WL^3}{6EI}$ (4) $\frac{WL^3}{16EI}$

157. A simply supported beam of span L carrying a u.d.l. registers a deflection of y cm at the centre. If the span of the beam is doubled, the deflection at the centre for the same u.d.l. would be

(1) $4y$ (2) $6y$ (3) $8y$ (4) $16y$

158. A simply supported beam of span l carrier a u.d.l. of w kg/m. What is the magnitude of concentrated load to be applied at the centre of this beam which would produce the same deflection as the u.d.l?

(1) $\frac{3}{8}wl$ (2) $\frac{wl}{2}$

(3) $\frac{5}{8}wl$ (4) $\frac{7}{8}wl$

159. Columns of same length, cross section and material different values of buckling loads and different end conditions. The strongest column is one whose

(1) One end is fixed and the other end is hinged

(2) One end is fixed and the other end is free

(3) Both the ends fixed

(4) Both the ends hinged

160. The radius of gyration of a circular section of diameter 50mm is
(1) 25mm (2) 50mm (3) 12.5mm (4) 20mm

161. The crippling stress varies
(1) directly proportional to slenderness ratio
(2) inversely proportional to slenderness ratio
(3) inversely proportional to the cubic power of slenderness ratio
(4) inversely proportional to the square of slenderness ratio

162. In the case of long columns the maximum permissible stress depends on
(1) The ultimate crushing strength of the material
(2) The maximum slenderness ratio
(3) Radius of gyration only
(4) Effective length only

163. A rectangular section has dimensions of 100mm × 200mm. The ratio of the moment of inertia about x-axis passing through its centroid to the moment of inertia about y-axis passing through its centroid is equal to
(1) 8 (2) 4 (3) 6 (4) 2

164. If the diameter of a long column is reduced by 20%, the percentage reduction in bucking load will be
(1) 4 (2) 36 (3) 49 (4) 59

165. The minimum percentage of reinforcement in R.C.C. short column is
(1) 0.3 (2) 0.8 (3) 1.0 (4) 1.5

166. Ties are load carrying members of a frame, which are subjected to
(1) Transverse loads (2) Axial tensile loads
(3) Axial compressive loads (4) Torsional loads

167. For a long column with hinged ends, the critical section is
(1) More than the yield stress (2) Less than the yield stress
(3) Equal to the yield stress (4) Zero

168. The moment of resistance of an over-reinforced section is determined on the basis of
(1) Tensile force developed in steel
(2) Compressive force developed in concrete
(3) Shear developed in steel
(4) Tension and compression developed in steel

169. In Limit state of collapse the maximum strain concrete at the outer most compression edge in bending is taken as
(1) 0.002 (2) 0.035
(3) 0.0035 (4) 0.02

170. The ratio of ultimate load to the working load is called as
(1) safe load (2) factor of safety
(3) load factor (4) partial safety factor

171. The characteristic mean strength of M30 grade concrete in N/mm^2 is
(1) 15 (2) 20 (3) 30 (4) 25

172. Limiting percentage of steel for M25 grade concrete for steel of fy = 415 N/mm^2 is
(1) 0.72 (2) 20
(3) 1.20 (4) 1.44

173. If a 'p' is the net upward pressure on a square footing of side 'b' for square column of size 'a', the width of footing is taken as
(1) $pb^2/8$ (2) $pba^2/8$
(3) $p(b-a)^2/8$ (4) $pb\,(b-a)^2/8$

174. The total area of the side reinforcement distributed equally along the two faces of a beam when the depth of the web exceeds 750mm
   (1) Shall be 1.0 percent of the web area
   (2) Shall not be more than 0.10 percent of the web area
   (3) Shall not be less than 0.10 percent of the web area
   (4) Shall not be more than 0.05 percent of the web area

175. The modular ratio of M30 grade concrete with 10N/mm^2 permissible compressive stress in bending is
   (1) 9.33 (2) 8.11 (3) 10.98 (4) 13.33

176. The anchorage value of standard U type hooks shall be equal to
   (1) 4 times the diameter of the bar (2) 8 times the diameter of the bar
   (3) 12 times the diameter of the bar (4) 16 times the diameter of the bar

177. The maximum bond stress allowed in RCC members depends upon
   (1) Cement content in concrete (2) W/C ratio in concrete
   (3) Grade of the concrete (4) Shear reinforcement

178. As per IS 456-2000, for mix design of M20 grade concrete, the assumed standard deviation is
   (1) 3.5 N/mm^2 (2) 4.5 N/mm^2
   (3) 5.6 N/mm^2 (4) 4.0 N/mm^2

179. As per I.S. 456 recommendations in a two-way slab, the width of the middle strip along each span should be
   (1) 3/8 of the width of the span in that direction
   (2) 3/8 of the width of the span at right angles
   (3) 3/4 of the shortest side of the slab
   (4) 3/4 of the width of the span in that direction

180. In an R.C.C. beam, the depth of the steel reinforcement from compression face is 30 cm. The modular ratio Es/Ec = 15 and the ratio maximum stress developed in steel and the maximum stress developed in concrete is also 15. The distance of the neutral axis from the compression face is

(1) 20cm (2) 18cm (3) 15cm (4) 12cm

181. As per IS 456, final deflection due to all loads including the effects of temperature, creep and shrinkage should not normally exceed

(1) span/150 (2) span/250 (3) span/225 (4) span/325

182. The splicing of the reinforcement bars in R.C.C. beams can be done at a section where

(1) shear force is zero
(2) bending moment is less than half the maximum B.M. on the beam
(3) bending moment is zero
(4) bending moment is more than half the maximum B.M. on the beam

183. The maximum spacing of shear reinforcement for beams in the form of vertical stirrups measured along the axis of the member shall not exceed

(1) 0.65d (2) 0.75d (3) 0.775d (4) 35d

184. For 200mm^2 steel with modular ratio as 19, the equivalent area of concrete is

(1) 3200 mm^2 (2) 3450 mm^2 (3) 3600 mm^2 (4) 2550 mm^2

185. The minimum eccentricity used in the design of RCC columns is given by

(1) (unsupported length)/500
(2) (lateral dimension)/30
(3) (unsupported length)/500 + (lateral dimension)/30
(4) (unsupported length)/500 – (lateral dimension)/30

186. The purpose of transverse reinforcement in a slab is
(1) to distribute the loads more uniformly
(2) to keep the main reinforcement in position
(3) to take care of shrinkage and temperature
(4) to take shear

187. The nominal cover for severe exposure conditions to meet the durability requirements should not be less than
(1) 20mm (2) 30mm (3) 40mm (4) 45mm

188. A short column of 300 × 30mm section is reinforced with 3040 mm^2 steel area, If the modular ratio as 13.33 and safe stress in concrete is 5N/mm^2, the safe load on the column is
(1) 620.58KN (2) 738.724KN (3) 730.495KN (4) 525.52KN

189. In a simply supported slab, alternate bars are curtailed at
(1) 1/5 of the span (2) 1/6 of the span (3) 1/7 of the span (4) 1/8 of the span

190. A long column is one whose ratio of eA length to its least latteral dimensial exceeds
(1) 5 (2) 12 (3) 15 (4) 20

191. The partial safety factors for loads in limit state of service ability condition for load combination of (Dead load + Live load + Winal load) for the Live load is
(1) 0.8 (2) 1.0 (3) 1.2 (4) 1.5

192. The limiting moment of resistance for Fe 415 steel is
(1) 0.149 fck bd^2 (2) 0.138 fck bd^2
(3) 0.133 fck bd^2 (4) 0.123 fck bd^2

193. The angles measured clock wise from any reference meridian are called as
(1) Bearings (2) Reduced Bearings
(3) Azimuths (4) Meridians

194. The direction of a line is measured by the horizontal angle between it and a chosen reference line is called as
(1) Azimuth
(2) Meridian
(3) Grid Meridian
(4) Traversing

195. If the area is covered by a series of survey lines near the boundary, it is called as
(1) Triangulation
(2) Theodolite surveying
(3) Traversing
(4) Gridison system

196. Establishing a set of intermediate points on a straight line between two points already fixed on ground is called
(1) Chaining (2) Traversing (3) Resectioning (4) Ranging

197. If the fore bearing of a line is N 26° 35' W, its back bearing will be
(1) S 26°35' E
(2) S 26° 35' W
(3) N 26° 35' E
(4) N 53° 25' W

198. The observed magnetic bearing of survey line is 25°30'E and the declination at the place is 2°30'E. The line bearing of the line is
(1) 23°00' (2) 27°30' (3) 28°00' (4) 12°45'

199. The linear closing error that may occur when plotting a closed compass traverse is adjusted by
(1) Bowditch rule
(2) Triangulation
(3) Orienting by resection
(4) Radiation

200. In the methods to reduce levels, the method provides a better check on arithmetical work is
(1) Height of collination
(2) Raise and fall system
(3) Traversing method
(4) Ranging